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CONTENTS.

ERRATA ET ADDENDUM.

VOL. 9, NO. 2, JUNE, 1938.

P. 22, line 25—After "bread" insert "and chopped, cooked meat."

P. 23, paragraph 2—Liens are made to contractors in addition to tenants.

P. 31, last footnote should read £150 million.

AGRICULTURAL JOURNAL

ISSUED BY THE

DEPARTMENT OF AGRICULTURE, FIJI.

VOL. 9.] SEPTEMBER, 1938. [No. 3.

EDITORIAL.

BY the time this issue is circulated, the Department will have welcomed back Dr. H. W. Jack, M.B.E., on return from furlough.

Commencing with the March issue, this is the third number of Volume Nine to be brought out in 1938, thus conforming to the programme of regular quarterly issues.

The decision made to include advertisements in the Agricultural Journal has met with good response and favourable comment has been received, indicating the increased value given to the Journal and, to some extent, the increased trade which has resulted therefrom. The types of advertisement show an improvement since they now include a greater number of illustrated blocks.

In selecting subject matter an attempt is made to choose only such material as is of local and general interest. It is at times necessary, however, to publish technical articles which no doubt have a limited reading public.

An article of special interest in this issue is that by Mr. B. E. V. Parham on the history and distribution of *Solanum torvum* (Swartz) in Fiji with notes on the possibility of its control. In addition, numerous articles are devoted to the growing of crops already well known locally. A variation in subject matter is introduced with the article on the potentiality of the cashew nut industry in Fiji. As usual, the Entomologist supplies several interesting notes on insects of economic importance. A statement in relation to the distemper outbreak among dogs is given and two rumours relating to the giant toad are dispersed. Since the article on toads was written, the Entomologist has found the banana borer features in its diet—a very promising discovery.

The notes on copra and its treatment in various countries is of more than outstanding local interest as it shows what is being aimed at abroad in the preparation of this product.

Departmental Notes are a new feature and provide an unofficial touch to the Journal.

THE HISTORY AND DISTRIBUTION OF *SOLANUM TORVUM* SWARTZ IN FIJI WITH NOTES ON THE POSSIBILITY OF ITS CONTROL.

By
B. E. V. PARHAM, M.A.,
Agricultural Officer, Central.

THE plant considered in this report is justly regarded as a serious pest of pasture land in Fiji, because it combines several of the worst attributes of a weed. It has excellent adaptations favouring its rapid spread over wide areas, is protected by thorns and by poisonous qualities and, besides having remarkably few natural enemies, is closely related to a host of important food plants—a fact which minimises the prospects of its control by biological means. It favours good soil and is unpalatable to stock.

The possibility of its control in Fiji has been investigated more than once in the past and active measures have been attempted from time to time in an effort to deal with it. A brief account of its history in Fiji and of the efforts made to control it is therefore necessary.

DISTRIBUTION OF *Solanum torvum*.

General.—The plant was first recorded from the West Indies and described by Swartz in " Nova Genera and Species Plantarum " published during the years 1783–87. Early records of its occurrence in many countries have made it difficult, if not impossible, to determine its true origin.

It is now a common weed in cultivated ground and forest clearings in tropical Asia, Malaya, Philippines, West Africa, America, West Indies and tropical South America but in none of these countries is it regarded as a noxious weed.

Local.—It has not been possible to discover the probable date of its introduction to Fiji. Greenwood (Barnes, 5) states that it was common in parts of Fiji in 1906 whence it is thought to have arrived from India, where it is a common roadside weed and occasionally is cultivated in gardens (Tothill 3).

By 1926 it had spread to such an extent that the Noogoora Burr Ordinance was extended to include this plant which up to that time had been erroneously known as *Solanum repandum* (1). This latter plant is the " sou " cultivated by the Fijians for its tomato-like fruit.

In 1930 prickly *Solanum* was recorded from Ba, Bua, Lautoka, Naitasiri, Nadroga, Rewa, Colo North and Tailevu Provinces; but had not been seen in Ra (Barnes, 5). In most of these places it was regarded as a serious pest and a menace to agriculture.

At the present time, prickly *Solanum* is recorded from most parts of the Group and has become prominent as a pest of pasture lands, where its eradication has become a major problem owing to the difficulty of handling and to the high rate of germination of the seeds which are distributed by the agency of birds (wild pigeons, doves and bulbuls), flood waters and cattle which transfer the seeds in mud on their feet. The plant flourishes in a variety of situations but prefers open moist places such as the sides of roads and water courses, edges of gullies and forest clearings.

ACTION TAKEN TOWARDS CONTROL IN FIJI.

The steps taken in the past to deal with this weed may be briefly summarized:—

1926—(*a*) Noogoora Burr Ordinance extended to include *Solanum torvum* Sw. as a noxious weed (1).

(*b*) Inspector appointed for eradication work in Sigatoka District—using direct methods: poisoning, flame throwers and mechanical eradication—none of which gave promise of success on a large scale.

1928—(*a*) Identification of *Solanum torvum* Swartz confirmed by Kew Gardens.

(*b*) Kew Gardens asked to furnish information as to country of origin and present distribution (2).

(*c*) Director of Agriculture explored the possibilities of control by all known means.

(*d*) Departments of Agriculture, India, Ceylon, Burma and Federated Malay States asked for information as to insect enemies.

(*e*) Advice of Director, Imperial Entomological Bureau (now Institute) sought.

(*f*) Government of Fiji, while undertaking to make inquiries as to the possibility of biological control, indicated the official position to be as follows:—

(i) in view of the fact that *Solanum torvum* is closely related to many plants of economic importance, it is unlikely, but not impossible, that insects can be found to feed upon it that would not become injurious to economic plants.

(ii) Government is aware that the plant is a pest of considerable importance and will undertake to make inquiries by correspondence with Entomologists in India with a view to obtaining further information.

1928—(*g*) The Director of the Imperial Entomological Bureau wrote stating he was in close agreement with the above official view and offering no further suggestions.

(*h*) Replies from Ceylon, India, Burma and Federated Malay States were not encouraging as there appeared to be no insects of outstanding importance feeding upon the plant in those countries.

From the information available it appeared that the only insects recorded were a leaf-feeding beetle (*Epilachna*), and two plant bugs (*Diphinctus humeralis* and *Aphis gossypii*! the latter an important cotton pest). The Entomologist, Federated Malay States, reported a Microlepidopteron as a promising enemy of the fruit (Tothill, 3).

1929— The Noogoora Burr Ordinance 1919 was repealed by the passing of "Noxious Weeds and Diseases of Plants Ordinance 21 of 1929" —and both Noogoora Burr and Prickly Solanum ceased to be recorded as proclaimed noxious weeds of the Colony.

1930—(*a*) Regulations of Ordinance 21 of 1929 were issued but no specific mention of *Solanum torvum* made.

(*b*) Director of Agriculture circulated a questionnaire on noxious weeds and their control in Fiji. (Barnes, 4). From the replies received it was evident that *Solanum torvum* was wide spread in the Colony. The only effective control methods reported were those of uprooting or grubbing out the plants by hand or cutting them down to the ground and ploughing out the roots.

1931— During the floods of 1930 at Sigatoka all Solanum which was submerged by water died. Simmonds listed *Solanum torvum* as among the six principal noxious weeds of permanent cultivation in Fiji and concluded that "the use of biological control against *Solanum torvum* is out of the question." (6–10).

1934 & 1935— Preliminary experiments with a proprietary weedkiller were made at Central Agricultural Station, Naduruloulou. Stands of the weed up to 12 feet high were killed out by spraying wiht this weedkiller, using strengths of 1·20 and 1·30. Small plants were destroyed by solutions of strengths up to 1·100. (Parham, 11). This material cost approximately 3s. 6d. per gallon, equivalent to 1½-2d. per gallon for the stronger solution and ½d. per gallon for the weaker solution used; and appeared to be of value for the control of the dense stands of seedlings which crop up after old plants have been cut down or removed. Sodium chlorate (2 per cent.) was also used in these trials but did not prove as effective; and has the disadvantage of being difficult to handle.

1937— Flame throwers were used at Tailevu but were stated to be unsatisfactory.

METHODS OF CONTROL.

A survey of the action taken to date during the past twelve years indicates that no simple or cheap method of control of this weed may be expected. The available methods which have been investigated may be discussed briefly:—

(i) The possibility of biological control by insects has been abandoned owing to the close relationship of the plant to other economic plants, viz., tobacco, tomato, eggplant, potato, Cape gooseberry, chillies, &c.

(ii) Legislation has been introduced to deal with the plant as a noxious weed; but, without subsequent action, has not achieved any useful result.

(iii) Experimental trials with flame-throwers and poisoning with arsenic have not proved successful.

(iv) Preliminary trials with weedicides have indicated the possibility of this method of control—which has the advantage of sinple application—but which might prove more costly than eradication by hand.

(v) Cutting back and rooting out or ploughing has been practised over a period of years and has been reported as satisfactory for particular areas (Barnes, 5).

The cost of controlling the weed in pasture land has been estimated at £1 per acre per annum and it has been stated that pasture land once thoroughly cleared of weeds can be kept practically clear by one man to every 50 acres. Initial clearing costs from 30s. to £3 per acre; but the great difficulty lies in the fact that re-infestation of cleared land is rapid owing to the transference of seed by various agencies from neighbouring infested areas.

The problem, therefore, calls for a consideration of the feasibility of clearing the pland from certain specified areas. To be effective, universal control measures would have to be extended to all such areas many of which are unproductive and do not justify the expenditure necessary to keep them free from noxious weeds.

Inasmuch, however, as effective control has been achieved by energetic land holders on their own properties, it is necessary that these should be protected from repeated infestation from areas owned by less careful neighbours. To this end, the plant should be declared a noxious weed in

certain areas where the agricultural activities of the community justify such action, and all landholders in that area should be required to suppress the weed.

The areas which would require to be defined so as to ensure a reasonable fulfilment of the necessary regulations, would be determined on the basis of population and agricultural development. Such legislation would at least assist the limiting of *Solanum* to the unproductive and unoccupied areas of the Colony where in the process of time re-afforestation or extending agricultural enterprise might become factors in the further control of the weed.

SUMMARY AND RECOMMENDATION.

(i) *Solanum torvum* Swartz is most serious as a weed in pastures and waste places but not in land under cultivation.

(ii) It is spread by seeds carried by birds, by water and by stock.

(iii) Its relationship with economic plants precludes the use of insects for its control.

(iv) Effective control by direct mechanical means is possible, *i.e.*, by cutting back and digging or ploughing out.

(v) Re-infestation of cleared areas is rapid and in certain localities could be reduced to a minimum by the assistance of legislation.

(vi) Owing to the sparse population of the country, this legislation should be restricted to certain defined areas where agricultural development justifies protection.

(vii) In such areas the eradication of the weed by all land holders should be compulsory, and Government would have to set an example by clearing Road Reserves and Crown Lands.

(viii) Further experimental work with weedicides with particular reference to costs should be undertaken.

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THE CULTIVATION OF BANANAS.

By
B. E. V. PARHAM,
Agricultural Officer Central and Plant Pathologist.

THE variety recommended for commercial planting at the present time is that known locally as "veimama." This variety is robust growing and bears well, bunches from 8 to 11 hands being common. The plant is not as tall as the Gros Michel ("Jiaina balavu"), is not so liable to damage by winds and the bunch is more accessible for dusting for control of scab-moth. While susceptible to leaf-spot disease (*Cercospora musæ*) this variety appears to have some resistance to the virus disease (bunchy-top) and is therefore preferable to Cavendishe variety ("Jiaina leka").

Propagation.—The best planting material is provided by large suckers (10 feet high) which are removed for the stool and cut off two feet from the corm. These butts may be 12 to 14 inches in diameter and are planted in holes about 18 inches deep partly filled with surface soil and well-rotted compost. A useful planting distance is 11 feet by 11 feet (360 per acre), in good soil the number of trees per acre may be increased by planting the suckers in pairs 3 feet apart and 11 feet between each pair which gives 540 trees per acre. The main shoots should not be allowed to grow and only one side shoot retained to give the main plant. Two followers may be left after the first 4 to 5 months.

Cultivation.—In selecting land for banana cultivation, a sheltered situation with deep soil gives the best results; the more exposed hillslopes with shallow soil and red-clay subsoil should be avoided. Although requiring a large amount of moisture the banana cannot tolerate stagnant water so that a well-drained site is essential. This variety does well both on the alluvial flat and on the lower slopes of forested gullies where there is abundant accumulation of humus.

While manuring is not necessary, the yield may be increased by monthly applications of sulphate of ammonia at the rate of two ounces per stool during the first five months or by abundant use of compost to which sulphate of potash may be added at the rate of 1 lb per 100 lb compost.

Cover crops of cowpeas, rice, bean or natural vegetation as mile-a-minute (*Mikania scandens*) or "sila" (*Coix lacryma-jobi*) are of great assistance especially in the wet zone. They assist in controlling weeds and may be frequently slashed to provide a mulch. Para grass (*Brachiara mutica*) is commonly permitted to grow in banana plots but requires constant cutting.

Pests and diseases.—The banana weevil borer (*Cosmopolites sordidus*) does little damage in a well-cared for plantation, its preference being for decaying tissues. In addition to control by the natural predators *Plæsius javanus* (Java beetle) *and Bufo marinus* (giant toad) it is possible to reduce the population by systematic trapping with pieces of banana stem placed on the ground, by hand-picking or by poison-baiting.

The scab moth causes heavy damage to fruit and is controlled satisfactorily by dusting with pyrethrum powder mixed either with sulphur or wood ashes in the proportions one to two respectively. The dusting must be done as soon as possible after the bud is shot and before it passes the horizontal position.

The most destructive fungal diseases is leaf-spot caused by (*Cercospora musæ*) which spreads rapidly and may result in a complete loss of the crop. Effective control is possible only by using fungicidal sprays (as Bordeaux

mixture 4–5–50 or Shirlan A.G.) but the effects of disease may be minimised by limiting the size of the plantation and by leaving natural barriers of trees between plots.

Bunchy-top is a destructive virus disease which is carried from plant to plant by the aphid *Pentalonia nigronervosa*. There is no direct control for this disease and affected plants should be removed immediately they are noted. It is desirable that the aphids be killed before the affected plants are removed and this is done by pouring a half pint of kerosene into the crown of the plant where the insects congregate.

The mature bunches should be cut for export at the thin—$\frac{3}{4}$ to $\frac{3}{4}$ stage—when the individual fingers have filled out but are still full green in colour with white flesh. The bunches should be handled with extreme care to avoid bruising as this is the primary cause of fruit rots which develop during transport and storage.

NOTE ON A HYBRID BANANA (I.C.2).

By
B. E. V. PARHAM, M.A.

In connection with a previous article (1) on new banana varieties at present being grown at the Central Agricultural Station the following extract from a report recorded from the Auckland agents (Messrs. Turners and Growers, Ltd.) on two cases of I.C.2 bananas shipped in February last may be of interest:—

> "On opening the two boxes, the Veimama were still quite firm and green but the other bananas (*i.e.*, I.C.2) were mostly golden yellow and a few spotted. However the smaller size fruit was still green. The flavour appears to be excellent, but the bananas are apparently more delicate then the Cavendish and Veimama.
>
> "I should imagine that this variety of banana would prove to be more popular with the public if we could handle them in large enough quantities to cultivate the public taste. In the meantime I would like you to send more when you have them available . . . . ."

Inasmuch as this variety continues to show practical resistance to leaf-spot disease in the field, this report on the market possibilities of the fruit indicates that it may prove a useful addition to the commercial banana varieties of the Colony.

(1) Parham, B.E., "New Banana Varieties for Fiji," Fiji Journal of Agriculture, Vol. IX, No. 2, 1938.

RAINFALL AND TEMPERATURE, SUVA: JANUARY TO AUGUST, 1938.

Month.	*Rainfall.*	*Mean-temperature.*
January	12·53 inches.	81·2° F.
February	8·45 ,,	81·8°
March	8·54 ,,	80·2°
April	4·96 ,,	79·5°
May	11·58 ,,	77·7°
June	4·84 ,,	75·9°
July	14·32 ,,	75·5°
August.	7·05 ,,	76·1°

The mean or mid-temperature is half the sum of the maximum and minimum temperatures.

—R. J. A. W. L.

NATIVE FOOD CROPS OF FIJI.

By
L. W. HARWOOD, H.D.A.
Agricultural Officer, Islands.

INTRODUCTION.

Much has been said about native food crops and native methods of agriculture and in this article it is intended to describe the main food crops and methods of cultivation adopted by the Fijians and also briefly to suggest new crops which may be of value.

PRINCIPAL FOOD CROP.

The natives of Fiji rely principally on—

1. Dalo or taro (*Colocasia antiquorum esculentum*).
2. Yams (*Dioscorea* sp.).
3. Cassava (*Manihot* sp.).
4. Breadfruit (*Artocarpus incisa*).
5. Kumala (*Ipomœa batatas*).

There are many other foods used by the Fijians but the five named above may be regarded as being the most important.

PREPARATION OF THE LAND FOR FOOD CROPS.

The method of preparing the food patch for planting varies slightly from province to province, but there appears to be one definite method for flat and wet land areas and another for the well-drained slopes. On the former soils the land to be planted is cleared and planted immediately, but on the slopes it is first weeded, the rubbish dried and burned and the crop planted. These methods are adopted for the preparation of dalo, kumala and cassava areas, but it is interesting to no e that in yam areas the rubbish is almost invariably burned.

1. DALO OR TARO (*Colocasia antiquorum esculentum*).

Dalo or taro (*Colocasia antiquorum esculentum*), a native of India, is a root crop grown in most tropical countries and as a result of being so widespread has many different names but in the South Seas it is called dalo or taro. This plant is a member of the Aroid family, its chief characteristics being a short stem and large arrow-shaped leaves which are borne on long petioles rising from the ground. Two main varieties are known, the leaves and the stem of one being green and of the other purplish coloured.

Fijian varieties.—The Fijians have named many of the two types and the following are those that the writer has heard mentioned:—

Wet land types, basaga (white and black), usa-i-wai (swamp type).
Dry land types, tausala, qere, tannea.
Wet or dry land, Samoa (does best on dry land); vavai (does best on wet land); maro, danui, botiki, sisiwa damu, sisiwa vula, madra, tausalo ni Samoa, Beqa.

Soil.—Dalo grows best in an open soil and as a rule flourishes where plenty of moisture is available.

Fijian planting method.—The Fijian prepares holes about 1 foot deep and for this work a digging stick, called "doko," is used. Propagation is by means of tops or suckers. The planting material having been selected, the tops or suckers are placed in the holes, which are usually about 3 feet apart. Two or three inches of soil is added to the hole after the planting material has been placed in position.

The growing dalo is weeded regularly until it is about seven months old and is then left until it reaches maturity at about nine months. Some varieties are grown on terraces, which are irrigated until the time when the flow of water is stopped. An average dalo should weigh about 5 to 6 lb.

Uses of dalo.—The bulbous corm is very rich in starch and is regarded as being a most nutritious food. The leaves of some varieties are used for "rourou" or spinach which is usually prepared with coconut milk; the stalk is often cooked in the same manner; the corm is cut up into pieces and boiled, and sometimes the already cooked dalo is pounded up, mixed with coconut milk and served as a pudding ("vakalolo"). "Rourou" made from the stalks is regarded by the natives in some districts as being a very valuable food for nursing mothers.

2. THE YAM (*Dioscorea* sp.)

The yam (*Dioscorea* sp.) is thought to be a native of tropical Asia but has been introduced to most tropical countries and in some has grown wild.

Varieties.—There are four main types:—

D. alata.—The Asiatic yam with quadrangular wing stems and large tubers.
D. esculenta, the Potato or Chinese yam, which is a thorny climber, with kidney-shaped leaves and small and plentiful tubers.
D. *cayenensis*, the Negro, yellow or Guinea yam.
D. rotundata, the common white yam.

The Fijians recognise many types of yams, the principal ones being:—kosokoso, taniela (red or white) vurai, botia, voli, daiqa, damuni, jamani, valagi, viwa, kaunidili, poa (white or red), rausi (white and red), uvi tivoli, Rotuma, sedraisasu, malolo, vutuna, lewe ni viwa, daku levu, laivo and the wild yams which are called tivoli and tikau.

Soil.—A rich deep friable sandy loam, which must be well drained is an ideal soil for the yam.

NATIVE METHOD OF PROPAGATION AND CULTIVATION.

The land having been prepared in the customary manner, selected seed yams or " vaci " are cut into pieces about 6 inches long. Hills are made with the digging sticks, the sets planted in the top of the mounds and covered with 2 to 3 inches of soil. In the election of seed and the cutting of " vaci " great care is taken to see that each set is provided with an eye from which the plant may develop. The usual spacing is about 3 feet by 3 feet.

In some districts, support is provided for the growing plant but in most parts of the Group the creeping habit is encouraged. As with dalo and cassava, either bananas or plantains are often planted at the same time as the yams so that when the root crop is harvested a permanent crop remains on the land.

The usual planting time is July or August, depending on the climatic conditions of the district. The yam matures in 8 to 12 months and should yield from 2 to 4 tons per acre.

Use of the yam.—This crop is a most valuable one to the Fijians as it may be stored for long periods and is greatly esteemed by them. It is usually boiled or baked.

3. CASSAVA (*Manihot* spp.)

Cassava (*Manihot* sp.).—This plant is a native of South America and is a prolific yielder. It is shrub-like in habit growing to a height of 5 to 8 feet and the stems are very knotty. The tubers may often grow to a great size.

Species.—Two types are recognized *Manihot utilissima*, the bitter Cassava and *Manihot palmata* var. *aipi*, the sweet variety. The main varieties named by the Fijians are:—Vula tolu, leoni, qamea and merelisita, the last being the sweet cassava.

NATIVE METHOD OF PROPAGATION AND CULTIVATION.

Cuttings, about 6 inches long, are cut from fully matured stems and planted about 5 sets to a mound, the sets being placed in a slanting direction.

As soon as the cassava is big enough to weed, it is thoroughly hoed or knifed, and about three weedings are made before the crop reaches maturity which may be from 3 to 9 months according to the variety planted.

Soil.—A sandy well-drained loam is generally regarded as being the best place for the planting of cassava but the soil must be rich as the crop is a prolific feeder.

Uses of cassava.—Apart from its value as a food crop, starch, cassava meal, tapioca and an antiseptic called cassareep may be made from this plant. In Fiji the only use of the cassava is for food purposes.

4. BREADFRUIT (*Artocarpus incisa*).

Breadfruit (*Artocarpus incisa*) a tree 30 to 40 feet high is a native of the South Seas but has been introduced to other tropical countries. Two types, which bear the same botanical name, are known, one being seedless. The varieties named by the Fijians are:—Uto dina, buco, koqo, bokase, nubu na oura and the seeding type uto ni Samoa.

PERCENTAGE COMPOSITION OF FOOD CROPS.

Crops.	Water.	Ash.	Crude protein.	Carbohydrates.		Fat.
				Fibre.	Nitrogen free-extract.	
Cassava	67·4	1·0	1·1	1·4	28·8	0·3
Kumala.	68·8	1·1	1·8	1·3	26·4	0·6
Soyabean (seed)	9·9	5·3	36·5	4·3	26·5	17·5
Cowpea (green legume) ..	83·7	2·0	3·0	3·8	7·0	0·5
Dalo	62·7	1·2	3·5	0·5	31·5	0·6

Cowpeas would play a very useful part in rotations and would also be of value in preventing erosion on the slopes. At each of the Demonstration and Training farms attempts are being made to provide suitable rotations for the district and at the same time to grow leguminous crops which are valuable not only as soil-improvers but as food.

In conclusion, the writer is of the opinion that the food-crops of Fiji could be improved greatly by:—

(*a*) the annual growing of an early or late maturing green manure crop on each plot;
(*b*) the establishment of definite rotations which would not exhaust the soil but add to its fertility;
(*c*) the encouragement of crops having a high protein content;
(*d*) wherever a farmer has livestock, the establishment of some form of "mixed farming," as is practised in Nigeria, and thorough preparation of the soil with plough and harrows before planting;
(*e*) the use of coral sand on the fallows.

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NOTES ON WEEDS IN FIJI.

By
B. E. V. PARHAM, M.A.

I—*Piper aduncum* Linn.

During the past five years this species of *Piper* has been noted as an aggressive weed plant in the south-eastern part of Viti Levu, it has apparently spread rapidly with Suva as the centre.

This plant has the form of a large shrub or small tree and is easily recognised by the articulated branches, the pale yellow-green foliage and the white curved catkin-like spikes which are produced abundantly on the upper sides of the branches.

The leaves are alternate, entire, shortly petiolate, elliptic-oblong, acuminate, membranous and rough, prominently ribbed beneath, with 5 or 6 primary veins on each side of the midrib. They are usually 6 to 8 inches long, 2½ to 3 inches broad, with recurved, scabrous margins.

The flowers are small, greenish-white, in long dense, recurved spikes up to 6 inches long, borne singly, opposite the leaves on the upper side of the branches.

The seeds are small and are carried by birds so that distribution over a large area is quickly achieved.

The plant occurs in almost pure stands in abandoned clearings along the Prince's Road, on the banks of the Waimanu and Waidina rivers in Naitasiri Province and along the Queen's Road in the vicinity of Lami. It grows very rapidly to the exclusion of other plant growth and is invading pasture land in various localities. It rapidly exhausts the soil and, as it has no economic uses, threatens to become a weed of some importance.

Known to the Fijians as "yaqona ni Onolulu" (*i.e.*, Honolulu *Piper*) and recognised by them as an alien plant, it has been identified recently by the Bernice P. Bishop Museum as *Piper aduncum* Linn. and referred to as a "native of Java, where it grows in the lowlands, especially in gulches. It does not occur in Honolulu."

It has been known in Fiji certainly since 1924 when specimens were collected by E. H. Bryant Jr. of the Bernice P. Bishop Museum, and its present distribution indicates that although it has not been very long established in the Colony it is likely to occupy increasing areas in the lowland areas.

THE YAM.

By
W. L. PARHAM, Agricultural Officer East.
and
MALELI DAKUI, Native Field Assistant.

Varieties of yams are very numerous and distinguished by a wide range of characteristics including that of earliness as in the "vurai" yam of Ba. Special mention may be made of the "kawai" (*Dioscorea esculenta*) bearing numerous small tubers and of the "bulo" (*Dioscorea pentaphylla*) which has a large tuber practically indistinguishable in the young stage from a potato.

Yams flourish throughout Fiji: a rich free soil and good drainage are essentials. The Fijians avoid soils infested by certain grasses whose young shoots would penetrate the tubers.

General observations confirm the Fijians' statement that yams respond best to planting on land that has been well burnt off. A depth of at least 18 inches of well-pulverised soil appears desirable. The natives obtain this by planting on steep slopes or by throwing up high beds.

In Jamaica, manuring of the land by tethered cattle is reported to improve yields (1). In the same reference one notes that in a yam-growing competition the ten winning hills took three men yearly a whole day to complete.

In Fiji abnormally large wild yams are to be found growing in land-slides which provides the maximum depth of finely pulverised and well-drained soil.

Small yams or pieces of large ones are planted. To prevent rotting, the Fijians rub the cut yam in ashes and delay planting for three or four days to allow the cut surfaces to dry.

In Fiji, yam planting is distinctly seasonal, preparation of the land beginning in July and planting being done in August. The hills are spaced at from 3 to 4 feet and clean weeding is very necessary.

Stakes or reeds must be provided to support the vines. The Fijian custom of utilising reeds which are bent over as the vines grow so as to form a low trellis-work has much to commend it.

The crop averages ten months, maturity being denoted by the yellowing and falling off of the leaves.

In digging, care is required not to damage the tubers if these are to be stored which is done in small roofed cribs, when the yams are often sprinkled with ashes.

Yields are estimated at from 4 to 5 tons per acre (2).

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(1) The Journal of the Jamaica Agricultural Society, 1930, Vol. XLI, No. 9, pp. 512–513.
(2) A Text-Book of Tropical Agriculture, Nicholls and Holland, Macmillan, 1929.

POTENTIALITY OF THE CASHEW NUT INDUSTRY IN FIJI.

By

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Agricultural Officer North.

THERE is an ever increasing demand and popularity for the Cashew Nut (*Anacardium occidentale*) which has been esteemed as a dessert nut by Europeans in India for half a century and possible much longer. It was apparently introduced by the Portugese at Goa on the Malabar Coast from South America in order to check erosion; from here the edible and medicinal properties of the fruit and tree became known to the Indians, who have found many uses for it. Within the last decade or so, the export of kernels, which was in the vicinity of 100,000 lb, has increased to date to nearly 10 million lb, and the Mangalore merchants to meet the demand, import nuts from East Africa to keep the Mangalore Kernel factories busy during the off season in India.

The popularity of the kernel as a nut food, and more especially its use in the confectionary trade in United States of America and Europe, has increased rapidly and the demand is now greater than the supply. This opens up the potentialities of this commodity being produced in Fiji to meet the demand that will—if it has not already risen—arise in the Dominions of Australia, New Zealand and Canada.

The writer sees no reason why the Cashew nut should not be a reasonably sound venture for Indians, Fijians and for enterprising Europeans. Admittedly it does not seem a very lucrative industry in India, where it gives a gross return of £4 per acre for crops gathered from wild trees, or rough plantings. To the best of the writer's knowledge they have not yet been

grown on plantation lines which may indicate that it is a crop that will return only a precarious income to planters; but this should not check peasantry planting in Fiji as it is estimated that the gross cash return would be increased by 33 per cent. when nuts are supplied to Australia, New Zealand and possible Canadian markets.

Other reasons why it should not be an economic failure in the early stages of peasantry planting, are:—

1. Cultivation practically nil after the first year.
2. There is ample land upon which it can be grown which is not suitable for other crops.
3. There should be a good local demand for raw and roasted kernels, as soon as the Fijian, Indian and European have been taught the food value and various uses for which it can be applied in culinary art. For instance, in Southern India there is a ready market for raw kernels for curries, Indian sweetmeats, and preserves. It is eaten with ghee, juggery, and coconut, fried in oil, ghee and mixed with gram and dhall; whole kernels roasted.
4. It is a very quick growing tree, said to yield fruit in some cases in 18 months. It commences to give economic returns in the fifth year and comes into full bearing at its tenth year.
5. Assuming failure to find a market for the product, the peasant would not have laboured in vain, as he would have built up a domestic fuel reserve, so important in the dry zone areas.

The following information gleaned from various sources and experience may I trust be of value to those who are interested in developing a domestic fire-wood reserve; and at the same time to those who desire a reasonably lucrative income but who are inclined to suffer from "malua" farming, *i.e.*, lazy or with lackadaisical methods.

The tree.—It is not particular about soil or climatic conditions, requires very little attention after the first year, and grows from sea level to 200 feet in Fiji. It may grow even to 1,500 feet, but none have been so far found above 200 feet by the writer. The tree is a native of Central and Southern America. It grows in Southern India, in laterite soil, and in sandy tracts with a rainfall, ranging from 150 to 30 inches respectively per annum.

It should do best in the drier zones of the Fiji Islands, as in the wet zones shedding of the flowers would be heavy. It has a spreading or straggly habit when growing in the bush and reaches a height of 25 to 30 feet. Its fruit consists of two distinct parts: (1) the large swollen pear-shaped stalk (cashew apple), 2 to 4 inches long which is juicy and astringently acid; this part is used in preserves. (2) The small kidney shaped brown to greyish nut $\frac{3}{4}$ to 1 inch long at the extremity of the juicy apple in which the edible kernel is found. The crushed shell of the nut is acrid and poisonous; all parts of the fruit are of various uses in medicines; the tree yields a gum which is obnoxious to insects and incisions made in the bark emits a juice which is indelible.

In Fiji the nuts are in season for about three months September, October, November, *i.e.*, on the dry zone of Viti Levu. There are several varieties but so far only three have been found by the writer in Fiji:—red, red and yellow, and yellow fruits. It remains to be proved which variety produces the best marketable nut. Trees commence to bloom from the middle of May, it is not yet known which variety has the highest percentage of set blooms or premature shedding of flowers. In cloudy weather setting is poor.

Quality of the kernel is of great importance. Good quality should be white, bold and hard; and sweetness is desirable. Travancore, South India, is said to produce the best grade and quality; and gives a kernel percentage of about 28 per cent. white East African is 30 per cent.

In weight the dried nuts vary from 60 to 150 per pound, large size nuts not necessarily producing the largest kernels.

Planting.—The ryots along the Malabar Coast generally dig holes amongst bushes or secondary jungle and plant two to three nuts and in some cases plant five inches deep, this is done so that the large cotyledons will not be seen or discovered by the children attending to the herds, as the former are fond of eating them. The strongest seedling is left, the others pulled up.

It is not usually sown in nurseries as the tap-root is easily damaged. Nuts can be planted in small coconut leaf baskets and after about four to six weeks the seedlings with the baskets intact are planted out and good results are obtained.

Spacing is about 30 to 40 feet apart giving 50 to 127 trees per acre; in Fiji spacing 20 x 20 feet would be recommended as apparently trees do not seem to spread or grow so high as elsewhere, if this be found to be incorrect there would be no harm done as later the intermediate tree could be cut out. (20 x 20 feet = 110 trees per acre). Planting is done after the first few rains, Fiji should be in November, December or January; at the end of the wet season intercultivation should be done but not during the heavy rains otherwise there will be heavy soil erosion.

Harvesting.—In India, the fruits with the nuts attached are cut off by means of a hooked knife at the end of a bamboo. This is not a good practice as the percentage of kernels is less, due to the nuts not being fully matured. It is better to allow the nuts with fruits or stem attached to fall and gather them from the ground.

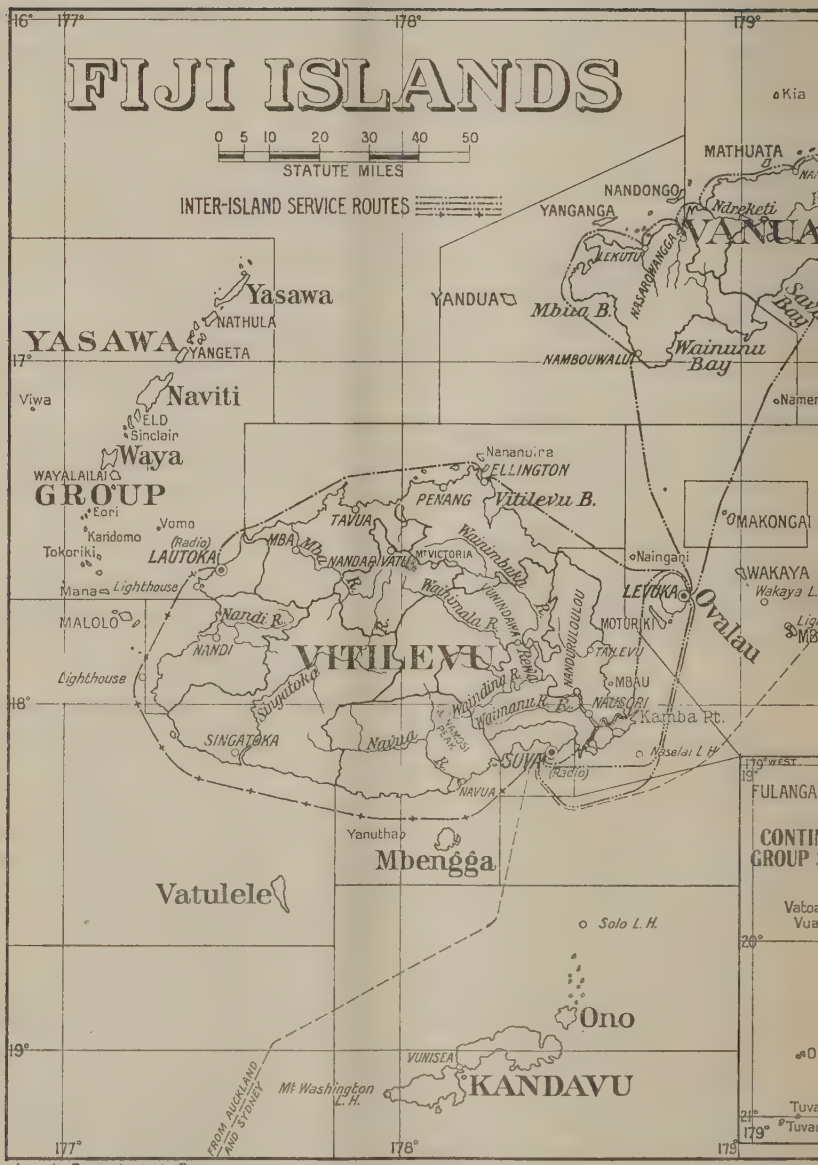
The average yield in India is reported as 20 lb of nuts per tree but there are trees producing as much as five times that quantity.

On decorticating or shelling the nuts, the yeild is between 25 to 30 per cent. of kernels, and after the thin skin covering the kernel is removed the yield of clean or peeled kernels is 80 to 90 per cent. wholes, the balance brokens.

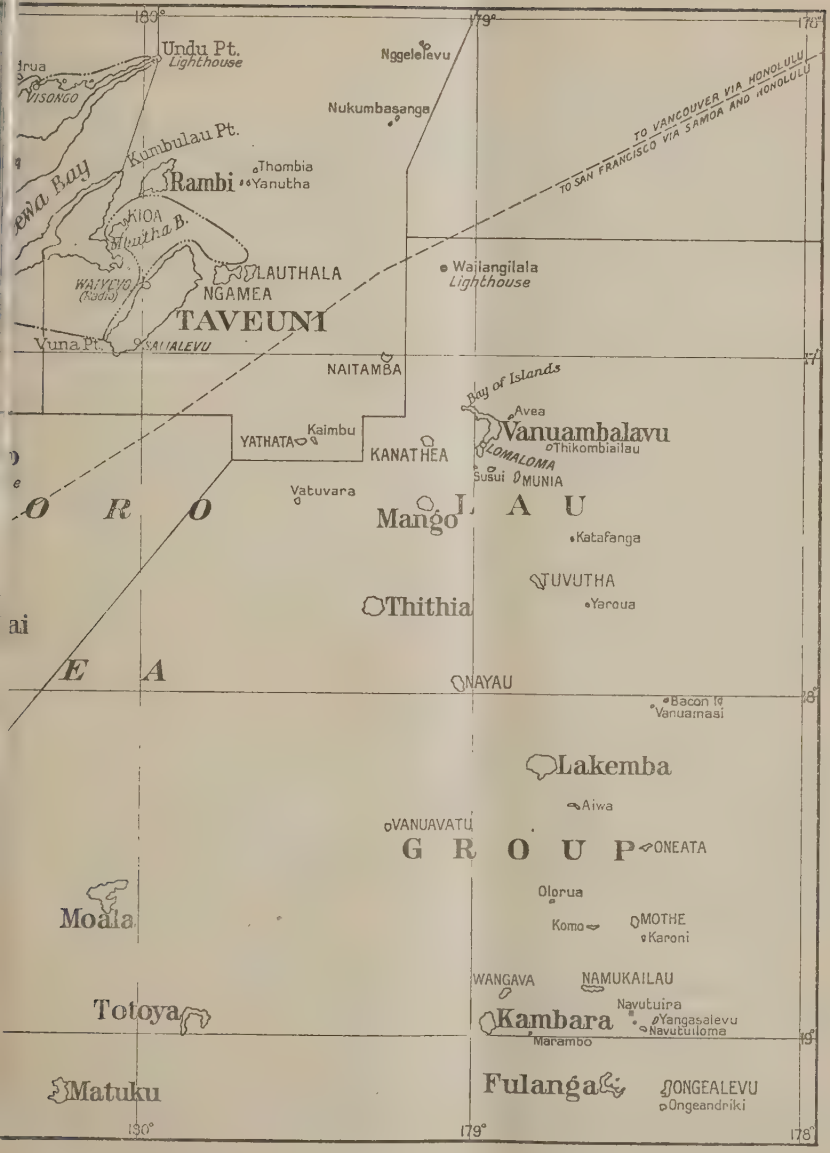
Preparation of kernels for eating.—The kernels are extracted by first ro sting the nuts which are then shelled and peeled. So far as the writer knows, decorticating, roasting and grading are not carried out by machinery in India, but one cannot help thinking that machinery will soon be produced to do the work and it is almost certain that the nut food producing factories in Australia will have some plant that could be adjusted for preparing and roasting the kernels as these factories are conducted hygienically.

It is not any use going into the details of preparation of kernels as it requires cheap female labour which is not available in Fiji. Therefore business in export trade would be done in nuts only, which has the advantage of being easily harvested by children and adults, and if well dried and bagged, will keep for many months without decorticating.

It might be added that details of the preparation of kernels are adequately described by Mr. W. J. Jenkins, M.A., B.Sc., of the Indian Agricultural Service in the Bulletin of the Imperial Institute, Vol. XXXVI, No. 1, 1938.



Lands Department, Suva.


180°
179°
178°
Undu Pt.
Lighthouse
Nggelelevu
Nukumbasanga
TO VANCOUVER VIA HONOLULU
TO SAN FRANCISCO VIA SAMOA AND HONOLULU
Kumbulau Pt.
Rambi
Thombia
Yanutha
KIOA
Kiutha B.
WAIYEVO
(Radio)
LAUTHALA
NGAMEA
TAVEUNI
Wailangilala
Lighthouse
Vuna Pt.
SALIALEVU
NAITAMBA
Bay of Islands
Avea
Vanuambalavu
Thikombiailau
YATHATA
Kaimbu
KANATHEA
LOMALOMA
Susui
MUNIA
Vatuvara
Mango
LAU
Katafanga
TUVUTHA
Yaroua
Thithia
NAYAU
Bacon Id.
Vanuamasi
Lakemba
Aiwa
VANUAVATU
GROUP
ONEATA
Olorua
Komo
MOTHE
Karoni
WANGAVA
NAMUKAILAU
Navutuira
Yangasalevu
Navutuiloma
Kambara
Marambo
Moala
Totoya
Matuku
Fulanga
ONGEALEVU
Ongeandriki

DOBUILEVU SCHOOL, VITI LEVU.

By
W. L. PARHAM,
Agricultural Assistant.

THE origin and activities of the Dobuilevu School may be of interest to those interested in agricultural extension work.

This school has its being owing to the initiative of the Fijian small-holders settled around the Demonstration Farm, Dobuilevu, Ra. In September, 1937, when the majority of settlers had been in occupation of their holdings for about eight months the heads of families petitioned the Director of Agriculture for support in obtaining a school of their own.

On inquiry it was found that the request was reasonable. The existing school was too distant for the children to be useful at their own homes, and as individual settlers the Fijians were finding their children very helpful and even necessary. There was also the difficulty that to give adequate support to the distant school was becoming a burden to people who were beginning to know the value of time.

By resolution of the Provincial Council all schools in Ra Province are managed by the District Commissioner. Accordingly the matter was referred to that Officer who took an immediate and an active interest. He had in particular the difficult task of smoothing the way for the opening of a new school in a " tikina " (district) which was justly proud of the school recently established by it.

One of the Fijian staff at the Demonstration Farm had had teaching experience, and the settlers asked for him to undertake this work. Permission was granted by the Director of Agriculture on condition that the children assisted sufficiently with the farm work to compensate for the time given up to teaching. Thus without design the school became associated with the Demonstration Farm.

The settlers did their part by building a substantial school " bure " (house) and by subscribing readily for the purchase of school necessities, but the concern of this article is rather with the agricultural side.

Firstly, and probably most important, the children were able to live at home and to take active part in their elders' work. As the Fijians realise, the children will be their superiors in such things as the handling of animals owing to their early familiarity with what is novel to their fathers.

It was agreed that the children should work on the Demonstration Farm for two afternoons each week. As their teacher is regarded highly by them, and as they number thirty-nine, their work is very useful. With regard to instruction in agriculture the hours spent on the Demonstration Farm are most valuable. Lead by their teacher they have taken over the care of the plots of economic trees, the picking of cotton and of annatto, and other light tasks about the farm. For instance, on one surprise visit they were found weeding around and cleaning the portable fowl-house.

Much of the difficulty found in establishing new crops is due to the need for profits to be made from crops while they are yet new to the grower. It is to be expected that at Dobuilevu the children will gain familiarity on the Demonstration Farm with new crops necessary for their successful introduction into general agriculture. Even more important is that the Demonstration Farm is planned to be worked as a model small-holding with particular attention being paid to the maintenance of soil-fertility and to the prevention of erosion. Familiarity with the work of the farm should fit the young Fijians to undertake to live on small farms without resort to the changes to new sites which is a weakness at present of small-holders of differing races in Fiji.

ENTOMOLOGICAL NOTES.

By

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1. FRUIT-FLIES AND THEIR CONTROL: BIOLOGICAL AND CHEMICAL.

THE species of fruit-flies authentically recorded from Fiji are only three in number, viz., *Chætodacus passiflorœ* Frogg., *C. xanthodes* Broun and *C.* sp. near *distinctus* Mall. On the strength of isolated but quite unsubstantiated records three additional species are given as Fijian insects, viz., *C. curvipennis* Frogg., *C. melanotus* Coq. and *C. psidii* Frogg. and one can see references even to the dreaded Mediterranean fruit fly (*Ceratitis capitata* Wied.) as a local insect, though this is quite erroneous. The three that are present have been studied in some detail by Simmonds (1) who illustrates them in colour and gives notes on their biology.

To the somewhat lengthy list of host-plants of the commonest species, *C. passiflorœ*, given in the bulletin referred to must be added *Eugenia braziliensis* Lam. and *Barringtonia speciosa* F., the latter recorded by Simmonds. Favourite hosts are the introduced granadilla, guavas as well as the rose-apple (*Eugenia malaccensis*), and the native dawa (*Pometia pinnatum* Forst.). Fortunately somewhat less attractive are the various kinds of citrus of which oranges and lemons were introduced from Tahiti in 1823 (2), while the shaddock or pumelo may be indigenous as it was abundant inland as long ago as 1860. By contrast, the mandarin was not apparently known in Fiji till about 1883 (3) when planting began: this fruit often suffers more from attack than the orange and the maggots may be found moving under the comparatively loose skin. For several years this insect attacked cotton bolls but it is no longer recorded from this plant.

The scarcer yellow fruit fly, *C. xanthodes*, has been reared by Simmonds from pawpaw which has therefore to be added to shaddock and granadilla as host-plants(1).

Two local Braconid parasites are described in this bulletin and specimens sent by the present writer to the Imperial Institute of Entomology show that the larger is *Biosteres tryoni* Cam. and the smaller one *Opius fletcheri* Silv. The latter insect comes from Mysore, South India, whence it was introduced in 1916 to Hawaii and thence to three important citrus-growing countries—Australia, Spain and California. It has recently been sent from Taiwan (Formosa) to the Loochoo Islands, south of Japan. Its occurrence in Fiji is rather perplexing as it is not given in Simmonds' list of introduced parasites (5); it may have arrived in citrus fruits, which are regularly imported from Australia, or any time since the 'eighties from India with immigrants. The African *O. humilis* was introduced (1) deliberately.

A third local parasite has recently been taken on Viti Levu and Taveuni Islands—a small, dark browm Braconid, identified by the Imperial Institute of Entomology as *Phænocarpa*. It is only 2 mm. in length and is the scarcest of the three indigenous parasites so far known.

Introduced parasites are also three in number, viz., *Tetrastichus giffardianus* Silv. (not to be confused with the other West African *T. giffardii* Silv.) sent from Hawaii in April, 1935; the robust Indian *Dirhinus* introduced in March, 1937, also from Hawaii, and another Indian parasite smaller than the African, viz., *Syntomosphyrum indicum* Silv. This last was first liberated in March, 1938, from stocks kindly sent by the Government Entomologist, New South Wales. It is of interest to note that this insect, which measures 1·5 to 2 mm., is by far the most constant in its development,

taking 16 days in the cool season, which is the same period taken in the much cooler climate of Italy (4) where it was introduced in 1907 and was sent next year to Western Australia and South Africa. Up to 35 parasites have been reared from one larva which should be a useful rate of reproduction for establishment in the Colony.

The accompanying graph shows the average mean monthly temperatures (kindly supplied by the Harbour Master before publication) with the developmental period of the three parasites spent inside the host larva and pupa. It will be seen that the development of all the parasites in days is, on the whole, inversely proportional to the temperature in degrees Fahrenheit, the rise to a maximum temperature in February being reflected by a shortening in development with a departure by *Dirhinus* from December till mid-February.

The parasites have been distributed locally this year to Viti Levu, Taveuni, Kadavu and Ovalau Islands. Overseas shipments of *Dirhinus* and *Tetrastichus* have been made to Western (New Zealand) Samoa and Rarotonga (Cook Islands) and of *Syntomosphyrum* to the latter and Oahu, Hawaiian Islands. *Dirhinus* is by far the hardiest of the three and travels with least mortality.

Free supplies of sodium fluosilicate have been made to a local grower who has a citrus orchard, although his area is not yet so large that bagging with pieces of hessian proves uneconomic. The quantities of the spray recommended are:—

1 oz. sodium fluosilicate,
2 lb white sugar,
4 gallons of water,

this being used at the rate of 1 gallon for 40 trees or $\frac{1}{4}$ acre. Glass fly-traps with the Queensland vanilla and ammonia lure are also used regularly.

The writer has been well served by his three native laboratory attendants: Philip of Gau, and Jonah and Isireli both of Kadavu, who have done excellent work in collecting fruits during the season when these are scarce and attended to the routine breeding of the parasites and subsequent parasitising of their hosts. Appreciation of their services is freely acknowledged here.

REFERENCES.

(1) Simmonds, H. W., 1935. Bull. No. 19, Dept. of Agriculture, Fiji.
(2) Seemann, B., 1862. A Mission to Viti, Chap. XVI.
(3) Wright, C. H., 1923. Bull. Miscell. Inform., Kew Gardens, No. 7.
(4) Silvestri, F., 1914. Bull. No. 3, Dept. of Agric. and Forestry, Hawaii.
(5) Simmonds, H. W., 1932. Agric. Journal, Fiji, V, 1.

2. IDENTIFICATION OF INSECT PARASITES.

In the March issue of this year's Journal reference was made (page 22) to three parasites of the ivi-nut moth *Cryptophlebia*. The Director of the Imperial Institute of Entomology, London, has now sent identification of these beneficial insects as follows:—The grey Tachinid fly is *Carcelia* (*Senometopia*) *kockiana* Towns.; the larger brown Braconid is *Macrocentrus* which, like the smaller *Apanteles*, has not yet been specifically determined.

The June number contains notes (page 15) on the local Braconid parasites of the fruit fly *Chætodacus* which are now known to be *Biosteres tryoni* Cam. and the much smaller *Phænocarpa* since taken additionally on Taveuni Island which is an extention of its range from Viti Levu.

Development of introduced
fruit fly parasites.

Temperature
Dirhinus
Tetrastichus
Syntomosphyrum

°F
.82
80
.78
.76
74
.72
.70

Days
.26
.24
.22
.20
118
.16
.14

1937 1938

Months O N D Jy F Mr A My J

3. MOSQUITO NOTES.

The common diurnal mosquito *Aëdes* (*Stegomyia*) *scutellaris* Walk. (=*variegatus* Dol.) breeds chiefly in water collected in old tins, split coconut husks, holes made by land crabs, lalis (wooden gongs) and in cavities in certain trees. In such a hollow at the base of a poinciana (*Delonix regia* Rafin.) in Suva adults of this mosquito were reared from water having a hydrogen ion reaction of 7·96; (relative alkalinity or acidity is expressed by means of certain arbitrary numerals, pH7 being that of neutrality, higher and lower numbers showing respectively a more alkaline and acid concentration.) The two determinations in this study were kindly made by the Acting Government Chemist and the value 7·96 thus shows the water to be slightly alkaline.

On June 27th, 1938, a number of larvæ of this mosquito was taken on Taveuni from water of pH 7·18 in the hollows which are such a characteristic feature of the ivi or Tahitian chestnut, *Inocarpus edulis* Forst. These trees were in the swampy area where in July, 1931, a colony of the giant Javan mosquito *Megarhinus splendens* Wied. was liberated by Paine. Owing partly to the depletion of this stand of trees for use as firewood, which has inevitably resulted in its becoming much more open, the number of *Megarhinus* mosquitoes was last June very low. One larva taken in this site did not pupate till August 10th—a period of six weeks—and emerged into an adult after six days as a pupa. Paine (1) found that the quantity of food, and not the temperature, was the determining factor and while the average larval (" wriggler ") stage was 16½ days it sometimes lasted as long as 143 days or over 20 weeks. The larva in question which took six weeks was given an adequate diet of larval *Aëdes scutellaris*.

(1) Paine, R. W., 1934. Bulletin Entomolog. Resch. XXV, 1, March.

4. ARMY WORMS AND CUT WORMS.

Caterpillars of certain dun-coloured Noctuid moths may at times be very numerous and do damage to plants by cutting the stalks at or about ground-level (cut worms) or they may advance in swarms or waves (army worms).

From time to time outbreaks of these insects are reported in Fiji and are seen from past records to be most numerous after the floods which usually occur towards the end of the wet season, particularly in February and March.

As late however as June of this year the author went to Viti Levu Bay at the Northern side of the island of that name to investigate an outbreak of a caterpillar pest which was damaging rice. The injury was found to consist of the spikes being eaten through so that the ripe grain fell to the ground and The damage was done in the evening only. The striped buff-coloured caterpillars shelter by day among the stalks just above ground level and pupate here or just under the soil. The insect proved to be *Cirphis unipuncta* How. which has almost a world-wide distribution from Great Britain, Siberia, Asia, Australasia and throughout the American continent (where it attacks maize, other cereals and pulses) to Hawaii where it is a pest of sugar cane, as is the case also in Fiji.

Although known to be parasitised by Tachinid flies and small " wasps," none of the specimens collected had been thus attacked. Mynah birds, toads and ground beetles in other countries exercise some toll and as all these are present in Fiji there should be some control by these means.

A poison bait of the following composition was mixed on the spot and left for application that evening:—

5lb of rice bran (procured from an adjacent mill).
¼lb arsenic trioxide (Paris Green will do instead).
3lb of sugar in 1 pint of water (in place of molasses).
1 orange, pulped.
1lb salt.
1 gallon of water.

This formula and the details below apply both to cut-worms and army worms. If outbreaks are very severe, trenches should be dug and the caterpillars collecting therein are to be crushed or oiled. Early harvesting is important for this crop and as the June outbreak had attacked late-planted rice, early planting out in December is important—even two weeks makes a difference. Burning over the stubble and subsequent ploughing is also recommended though it is apparently rare in Fiji for severe outbreaks to occur in two consecutive years.

It is worth mentioning that Veitch and Greenwood (1) do not give rice as a plant attacked by this insect but simply say that it destroys the leaves of sugar cane and feeds on the leaves of other Gramineæ (grasses). It is possible, however, to infer from a local report (2) that this insect was a pest on rice in 1931 and it was unhesitatingly recorded from this crop next year at Labasa, Vanua levu.

In August there was a slight outbreak of cutworms on tobacco at Sigatoka and moths reared from caterpillars sent in by the Agricultural Officer West developed into the moth *Agrotis ypsilon* Rott. which has not been recorded, apparently, in Fiji either economically or otherwise.

(1) Veitch, R., and Greenwood, W., 1921, Proc. Linn. Soc., N.S.W., XLVI, 4.
(2) Annual Bulletin of Divisional Reports, 1931. Department of Agriculture, Fiji.

5. A CATERPILLAR PEST ATTACKING STORED COPRA.

Mention was made in the March issue of this Journal (page 25) of the infestation of stored copra by grubs which turned out to be the beetle *Necrobia*. Since then another inquiry has been made asking for information and advice on a different insect that attacked a particularly good sample of copra which had been kept as an exhibit. The harmful insects in this case were the pinkish caterpillars of *Ephestia cautella* Walk., which is a greyish-brown moth with a dark band running across the forewings whose span averages two-thirds of an inch. It has also been bred in Fiji from raisins.

Owing to its attacking dried fruits, this tropicopolitan insect is sometimes known as the fig moth and it is interesting to note that Richards and Herford (1) while listing cocoa, nutmegs, cereals and various dried fruits do not mention copra as being one of the substances found attacked by it in London warehouses. However, it is well known in the Solomon Islands and Malaya and in the latter country it has been studied intensively by Corbett (2) who shows that the caterpillars are unable to penetrate well-prepared copra, but are attracted to it when improperly prepared as the soft degenerated "meat" is very palatable. Further, the average life cycle on mouldy moist copra was only 33 days, on mouldy dry copra 50 and on good dry copra as long as 60 days, showing how poorly nutritive is the last mentioned grade which is, or should be, the producers' aim.

It is considered if sacks were freed from rice débris before being filled with copra and if storage places were periodically cleaned, this moth would cease to be associated to any extent with copra which is certainly neglected by the caterpillars till they have first consumed any rice.

Fumigation may be necessary and carbon bisulphide at the rate of 4 lb for each 1,000 cubic feet of space is recommended for sacks which should remain in the vapour for 24 hours. The more simple method of soaking the bags for two minutes in boiling water as recommended for *Necrobia* (2) may appeal more locally as it can be carried out easily on all estates and in smaller country stores and can also be done by non-Europeans.

A point of interest is that this sample of Vanua Levu copra sent by the firm asking for information had been kept as an exhibit and when signs of insect attack were noticed it was then placed for three or four months in an air-tight jar. When kept in a fine gauze cage in the laboratory it was found to be parasitised by a Braconid wasp taken to be *Microbracon hebetor* Say. This is a brown insect measuring 3 mm. in length, the thorax is dark brown and the abdomen tawny; the female is recognizable, apart from the ovipositor, by having the abdomen much wider from the dorsal to its ventral surface. As up to 10 or 11 wasps have been reared from one caterpillar it will be seen that this is a parasite of no little importance in the control of *Ephestia* though some paralysed larvæ are cannibalistic and so off-set the parasitism.

(1) Richards, O. W. and Hereford, G. V. B. 1930. Ann. App. Biol. XVII, No. 2.
(2) Corbett, G. H., Yusope and Hassan, 1937. Dept. of Agric. S.S. and F.M.S. Scientific Series No. 20. 50 cents.

6. A CATERPILLAR DAMAGING SCREW-PINE LEAVES.

VARIOUS species of screw pine—the *Pandanus* of botanists and "voivoi" of the Fijians—were found in July and August to be attacked by insects. Specimens were sent by the Agricultural Officer East from Tailevu and Serea and taken by the writer on Galoa Island, Kadavu and near Suva.

Both the smooth and spiny types of leaf are attacked but *P. caricosus* seems the preferred host-plant.

The damage is done by the flat, ivory-coloured caterpillars of the Tineid moth *Aeolarchis sphenotoma* Meyr. which usually measures 20 mm. across the brown and buff fore-wings. The voivoi leaf provides the wherewithal for making house mats and as the caterpillar injures the surface so as to render it useless for this purpose, it will be appreciated that it may be a pest of no little importance to the natives. The insect pupates on the surface of the leaf within a web.

The treatment recommended was the application of pyrethrum powder mixed with three times its bulk of lime or wood ash: this can easily be applied by means of the rubber blowers used regularly with the same insecticide against *Nacoleia* (scab-moth) of bananas.

Two parasites have been recorded: a Syrphid fly which failed to emerge from its pupa, but is probably a species of *Melanostoma*, and a minute Chalcid wasp only 2 mm. in length.

7. AN INTERESTING COCONUT LEAF MOTH.

In 1921 the late Edward Meyrick, F.R.S., described (1) a new moth from three specimens sent from Lautoka and Cuvu, respectively, or the north-west and south-west coasts of Viti Levu. Subsequently the joint collectors recorded (2) the food-plants of this insect—*Decadarchis heterogramma* Meyr.—as the pith from dead stems of the Mexican sun-flower *Tithonia* and old dry pods of *Mucuna aterrima* (Mauritius or Bengal bean.) The next stage in the study of this moth was its finding as far west as Malaya by Corbett who records it (3) as feeding on the dead tissue of coconut leaflets. In December, 1933, Paine bred specimens from the pupæ of the spike moth, *Tirathaba trichogramma* Walk., which formed an article in the diet of *Decadarchis* in cages kept at Ura, Taveuni Island. (These data are taken from a single specimen in the collection of the Entomological Division in Suva). The next reference is made briefly by Simmonds (4) who stated the larvae apparently do little damage and in some cases only old diseased leaves are attacked. In July, 1938, the writer bred numbers of this moth found on enveloping spathes of coconut at Vatuwiri, Taveuni. It was on the grooved outer surface of this part that they pupated in a web, the pupa being 10 mm. long.

It is of interest to note both the wide range in the food (pith, pods, leaflets and pupæ of a moth) of this species and its wide distribution from Malaya to Taveuni—some 5,200 miles. The genus extends from Malaya through the Solomons as far east as Tahiti.

The moth is brownish grey with dark ochreous stripes and streaks on the forewings whose span averages 17 mm., the head, thorax and hind wings are whitish.

(1) Meyrick, E., 1921. Exotic Microlepidoptera, Vol. II, Pt. 15, November.
(2) Veitch, R., and Greenwood, W., 1929. Proc. Linn. Soc., N.S.W., Vol. LIV, Pt. 4.
(3) Corbett, G. H., 1932. Dept. of Agriculture, S.S. and F.M.S., General Series, No. 10, October.
(4) Simmonds, H. W., 1938. Dept. of Agric, Fiji, Bull. No. 20.

POULTRY-CULLING FOR PROFIT.

By

H. R. SURRIDGE, A.R.C.Sc.(I), B.Sc.

Poultry farmers are in general, aware of the fact that all birds in their flocks are not good layers, but it is not realized how great a loss is incurred by the presence of poor layers.

In Fiji, poultry farming is still in its infancy and reliable records of total eggs laid per bird during any laying season are conspicuous by their absence. It is doubtful whether birds of known laying strains are as prolific in the tropics, such as Fiji, as they are in the more temperate countries of their origin. It is advisable and necessary therefore, for the poultry farmer in Fiji to consider ways and means whereby all possible losses are reduced to a minimum so that the benefits of initiative, efficient organisation and management may reap their maximum reward. Normal losses for this Colony may be expected from raids by mongoose, hawks, disease and poor stock, and it is the object of this article to indicate how culling will assist the poultry farmer in reducing his loss from poor stock, improve the general standard of his birds and therefore his returns.

Culling for profit is the practice of eliminating all unprofitable birds from the poultry flock, thus ensuring that only birds returning a profit are kept on hand, the discards being fattened off and sold for table purposes.

It is obvious that when poultry are reared for egg production, only those which are definite egg-producers should be retained while those that are lazy, deformed or otherwise not up to standard should be eradicated. A hen that will, in Fiji, produce an average of two eggs per week throughout the whole of a laying season, which normally covers about 12 months, will always return a profit to its owners.

It has been stated by poultry authorities that on an average poultry farm, 33 per cent. of the flock is unprofitable, in other words, out of a flock of 300 birds, 100 birds do not earn any profit. They however, have to be fed, housed, and cared for with the result that much of the profit earned by the other 200, instead of accruing to the owner, must be spent in the maintenance of the unprofitable birds.

It must be recognised that no matter how good a pen of birds may be, their progeny will not be 100 per cent. perfect. If this fact is appreciated the necessity for culling will be apparent.

Culling is a continuous process for not only must poor layers be weeded out, but hens and pullets that produce small or misshapen eggs must be eliminated so that only the best layers are retained for egg production and breeding purposes. The separation of such birds from the flock is quickly reflected in the cash returns received.

The results of culling amongst the commercial flocks of New Zealand, Australia and elsewhere have often been startling; though a half to a third of a flock is discarded, yet egg production has been maintained proving that the profitable birds were supporting unprofitable ones at the expense of their owner.

It should be remembered that the hens left after their first laying season will invariably be profitable for a second laying season, nevertheless the culling must still be continued. This introduces another and important aspect for it is from birds such as these that all breeding stock should come, since the progeny of good profitable birds should tend to carry a good proportion of the parents' good qualities and thus help in building up the flock.

POINTS OF IDENTIFICATION.

The general characteristics of the utility-laying strains such as White Leghorns, Black Australorps, Rhode Island Reds, &c., are distinctive in type, size, &c., but there is one common factor, the factor of sex characteristics which is evidenced by the size and type of comb in each case.

A finely textured comb invariably denotes a bird of high fertility and vitality, while a coarse rough dry comb represents the opposite.

This peculiarity is of great assistance in identifying at all times, other than during the moulting season, the productive bird as against the non-productive or unthrifty bird, and here it should be noted that texture is not observable by sight but by touch. One feels by the texture and decides whether it is fine or coarse and the feel of a fine-textured comb is similar to the feel of the lobe of the human ear.

Further, a bird with a fine-textured comb usually has a well-developed body compatible with good egg-production, while the hard coarse comb is usually associated with poor development and low productive capacity.

There are of course, degrees of fineness, but if the novice will in the first instance accustom himself to the feel of a fine-textured comb and a definitely hard comb, experience will quickly be acquired and identification of thrifty and non-thrifty birds rapidly made.

Further, a good layer will have a long, deep body with breast roughly parallel to the back bone, with a depth between equal to the width across

the back. The body of an unprofitable bird is usually wedge-shaped, while the comb has the tough feel of felt.

The poultry farmer from the foregoing identification-marks should be able to cull or separate the unprofitable birds from the profitable birds, thereby raising the profit-earning capacity of the flock, while disposing of the rejects as table birds at an early stage at a small profit.

Finally, the aim of the poultry farmer who carries out culling, should be to have on hand two pullets for every hen, that is, that when the culling of hens is complete up to the moulting period, the number of hens then on hand should not be less than half the number of pullets which have just come into lay. Such a combination is profitable, for it will be necessary to continue culling after moulting of both hens and pullets so as to maintain egg production while disposing of the unprofitable birds.

The final test of productivity of any hen should be the count of eggs laid. This is done by means of trap nests, the operation of which may be seen at the Nasinu Farm. It is obviously a difficult matter to test all birds by such means, nevertheless serious poultry farmers should have some trap nest equipment. By means of these it would be possible to gain accurate information concerning hens where there is any doubt as to their laying ability.

To summarise, culling for profit means eliminating all birds which do not yield a profit therefore, cull early, that is as soon as the identification marks above quoted can be recognized, cull continuously and cull both male and female.

PLANT HORMONES.

[Some fifty years ago popular imagination was stirred by discoveries made about the so-called ductless glands of which the pituitary, thyroid and pancreas are examples. It was found that these organs secreted a substance which, when liberated into the blood-stream, had the most profound effects and this substance was accordingly given the name of "hormone" derived from a Greek word meaning to stir up or arouse. An instance of the action of a hormone is seen in the secretion from the pituitary body in the brain which, depending on its over abundance or great scarcity, determines whether a person is a giant or a dwarf. Very recently hormones have been found to affect the growth of plants and the following joint article describes the first experiments in the Colony made with a proprietary phytohormone or a substance which stimulates plant-growth. —Editor, "Agricultural Journal."]

HORTOMONE A AT NADURULOULOU.

By

B. E. Parham, M.A.

The following experiments were carried out at the Central Agricultural Station, Naduruloulou:—

First method (A).—Cuttings of similar size and age of each of the following plants were selected at random, Nos. 2 and 3 being chosen as rather difficult subjects:—

1. Rose, 4 cuttings.
2. *Allamanda violacea*, 5 cuttings.
3. *Lagerstrœmia flos-regina*, 6 cuttings.

The cuttings were planted in similar soil in two concrete tubs and watered. The recommended solution of Hortomone A (1 ounce per gallon of water) was sprinkled on the soil at the rate of one half-pint per square foot of surface.

The following table shows the results obtained:—

Plants.	Number treated.	Date planted.	Plants growing on			
			23/6/38.		31/8/38.	
			A (treated)	B (control).	A (treated).	B (control).
1. Rose	4	6/4/38	2	2	1	2
2. *Allamanda* ..	5	....	5	3	5	2
3. *Lagerstræmia* ..	6	....	1	1	0	0

All the rose cuttings sprouted in both tubs but died subsequently with the exception of two in the untreated soil and one, making poor growth, in the treated soil.

The best results were obtained with the *Allamanda* cuttings, all those in the treated soil growing well with the development of a larger root system than those in the untreated soil, where only two survived.

The *Lagerstræmia* cuttings all failed in both cases.

Second Method (B).—The direct method of treating cuttings was given a trial, using "yaqona" (*Macropiper methysticum*) cuttings.

Twenty-four cuttings were selected and placed in the standard solution of Hortomone A (1 ounce per 2 gallons water) for 18 hours, rinsed in water and 12 planted in a tub and 12 in a nursery bed. The controls (24 cuttings) were placed in rain water for 18 hours and planted out. The results were as follows:—

Plants.	Number treated.	Date planted.	Plants growing on 31/8/38.	
			A (treated).	B (control).
Nursery: Yaqona	12	27/5/38	0	8
Tub: Yaqona ..	12	„	0	8

The treated cuttings failed with the exception of one which produced a bud $\frac{1}{4}$ inch long but which had made no growth by the end of the period three months. The controls showed a 75 per cent. strike.

The experiments noted above were of a preliminary nature as only a limited quantity of the Hortomone A was available.

The results indicate that the treatment may be beneficial for certain plants (*e.g. Allamanda*) and of little value, if not definitely harmful, for others. It also appears possible that come cuttings may do better under method A and others under method B.

Further trials would be necessary before any definite statement could be made as to the advantages of using the substance under local conditions.

HORTOMONE A AT NASINU.

By
H. R. Surridge, A.R.C.Sc.(I), B.Sc.

A sample of Hortomone A was received in Fiji in March, 1938, from the manufacturers. It was issued for experimentation to the Officers-in-Charge of the Citrus Research Station Nasinu and the Central Agricultural Expermental Station, Naduruloulou.

Directions for use supplied with the sample were briefly as follows:—

Treatment for:—

(1) Cuttings.—Stand the cutting in a dilute solution of the Hortomone A substance of a strength of 1 part to 160 parts of water for 14 to 18 hours, then thoroughly rinse the ends in water and plant as usual.

(2) Propagating Beds.—Prepare a dilute solution of 1 part Hortomone A to 80 parts of water. Plant cuttings as usual, water thoroughly and then water the bed with the prepared solution at the rate of ½ pint per square foot. Leave unwatered for 14 to 18 hours.

It is recommended to use only freshly-prepared solutions and not to exceed the strengths stated especially with the softer types of cuttings for which weaker solutions are suggested.

At Nasinu Citrus Research Station, the following cuttings were used:—

(*a*) Using solution of 1 in 160:—

Garcinia mangostana (sweet mangosteen)	50 cuttings.			
Persea gratissima (Avocado pear) ..	20 cuttings, 2nd year wood.			
do. do.	20 cuttings, 18 months.			
do. do.	20 cuttings, 11 months.			
do. do.	20	,,	9	,,
Cassia nodosa	50	,,	18	,,
C. mochata	50	,,	18	,,
Citrus sinensis, sweet orange, Valenica Late variety	50	,,	6	,,

(*b*) Using strengths of:—

1/160 *Persea gratissima* (Avocado pear)	10	,,	6	,,
1/320 do. do.	10	,,	6	,,
1/640 do. do.	10	,,	6	,,

(*c*) Propagating beds:—

Using 1/160, 1/320 and 1/640 strengths with *Persea gratissima* material of 6 months old, 10 cuttings of each.

Results.—All controls (untreated cuttings) died within a month.

All treated material died within two months, except for one *Garcinia* and four *Persea* cuttings which died within three months.

Finally, 50 fruit-buds each of sweet orange of varieties Valencia Late, Parramatta and Washington Navel treated as for cuttings at standard strength (1 in 160) and with a similar number of controls, all failed.

Further trials are being made.

DISTEMPER AMONGST DOGS.

The occurrence of distemper amongst dogs in Fiji is remarkable for the very long intervals which have occurred between epizootics of this disease. Although it is almost certain that distemper occurred prior to 1923, there appears to be no written record of its occurrence. In 1931, however, a most acute epizootic of this disease took place in Fiji and the mortality at that time was very heavy. Following the subsidence of that outbreak no further cases occurred until this year when isolated cases began to appear about June and since then a very large number of animals have been affected. It is pleasing to relate, however, that the epizootic is now on the wane. The 1931 outbreak was notable for the severity of the symptoms shown. All forms of the disease were noted and mortality was experienced as a result of the nervous form, pneumonic form and enteric form. A feature of that outbreak was the rapid onset of death following congestion of the lungs occurring with pneumonia. In the present outbreak the symptoms have been of a much milder type—although nervous, pneumonic and enteric forms have been experienced—but the incidence of the nervous form was rare whilst every case was affected by a croupous form of pneumonia, which was characterised in most cases by severe coughing in the very early stages and then a complete cessation of coughing during the remainder of the course of the pneumonia. A further characteristic was that most dogs developed a mild enteritis associated with diarrhœa about half-way through the course of the illness. This condition, however, in most cases rapidly cleared up. The mortality was about 10 per cent. as against very much greater incidence in 1931. In this outbreak we have been fortunate in having available for treatment a supply of canine distemper serum obtained from the Commonwealth Serum Laboratories, Melbourne, and the low mortality experienced on this occasion is no doubt due in a large measure to the use of that serum.

—C.R.T.

THE GIANT TOAD.

1. Food.

It is understood that many Fijians believe that the giant toads recently imported into this country are preying on prawns and fear that as a result prawns will disappear from our creeks. There is no foundation of fact in this belief. Toads are land-feeders and therefore do not enter water to take their food and there need be no fear that the numbers of prawns will be decreased as a result of the presence of toads.

Another belief is that the tadpoles of the toads feed on mosquito larvæ and will thus be helpful in lessening mosquito pests. This also is untrue as tadpoles feed on algal plant matter for the most part and an experiment conducted by the Entomologist shows that the tadpoles do not attack mosquito larvæ even in the absence of other food.

—C.R.T.

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2. Reproduction.

The Surinam toad introduced into the Colony in February, 1936, has at least two breeding seasons per year as eggs were found by the writer in February and August, 1938. As they occur in chains up to 25 yards long and 13 is the average number of eggs occupying an inch of spawn, it is clear that a chain will consists of about 12,000 eggs and there is reason to belive

a female can produce two such chains at each spawning. This would give no less than 20,000 eggs, though an American species of toad laid 28,000 eggs in 10 hours.

The clasping reflex said by Rostand to occur in all males during the breeding season in temperate latitudes was found not to be a feature of *Bufo marinus* in August as a male failed repeatedly to respond to any object presented between its forelegs during the breeding season.

At an atmospheric temperature of 75° and a water temperature of 74° F., the eggs take about 48 hours to hatch.

—R.J.A.W.L.

DEPARTMENTAL NOTES.

TRANSFER OF MR. H. M. STUCHBERRY.

Many members of the public and of the staff of the Department of Agriculture have expressed regret at Mr. Stuchberry's leaving us on transfer to Tanganyika Territory. Nevertheless, since he goes on promotion, he has our congratulations and best wishes.

Mr. Stuchberry joined the Department of Agriculture as Veterinary Officer in 1928 and during his service in Fiji has been stationed both in Suva and in the western districts and has gained many friends amongst all classes of the community. Apart from his skill as a veterinary surgeon, he was well known on the golf links. On several occasions he acted as Senior Veterinary Officer in the Department of Agriculture and his promotion to Tanganyika Territory is a well merited one.

THE RESIGNATION OF MR. L. H. DIETRICH.

As a member of the Produce Inspection staff of the Department of Agriculture, Mr. Dietrich has been a prominent figure on the wharf at Suva since 1930. He has resigned to take over the managership of the Metropole Hotel in Suva and our best wishes go with him also.

MR. P. L. R. CHARLTON.

Congratulations are due to Mr. P. L. R. Charlton of the Chemical Division on his obtaining the degree of Bachelor of Science of the University of New Zealand, and on his temporary appointment as Acting Government Chemist.

RHINOCEROS BEETLE.

Mr. H. W. Simmonds, O.B.E., late Entomologist in the Department of Agriculture, left Suva on August 18th on a mission to Java and Malaya to endeavour to obtain parasites for the control of the rhinoceros beetle in Samoa and at the same time to endeavour to locate further parasites of the housefly for establishment in Fiji. The mission is being sponsored conjointly by the Governments of New Zealand and Fiji. Our best wishes go with Mr. Simmonds for the success of his mission.

APPOINTMENT OF DAIRY INSPECTOR.

The sanitation of dairies and of butter and milk production in this country is under the control of the Medical Officer of Health. Until the recent appointment of Mr. Bunge there was no officer fully engaged in this duty. With the appointment of the above officer, who will devote his whole time to dairy sanitation, it is anticipated that a considerable improvement will be brought about in the sanitation of dairies and of premises where butter and ghee are manufactured.

Since coming to Fiji, Mr. Bunge has been employed as herd tester to the Fiji Pastoral Co. Ltd., Navua, and more recently as milk distributing officer of the Rewa Co-operative Dairy Company. The best wishes of the Department go to Mr. Bunge on his new appointment.

MR. J. J. C. SUCKLING.

A welcome to the staff is accorded Mr. J. J. C. Suckling, who was appointed as an Agricultural Assistant with effect from 1st July, 1938. For the time being, Mr. Suckling is posted to the Nasinu Experimental Station.

REVIEWS.

SIR FRANK STOCKDALE'S REPORT ON FIJI.

Sir Frank Stockdale's eagerly awaited report* on his visit to Fiji has at last become public property and local people have now the opportunity of knowing how Fiji agriculture, animal husbandry and the people associated with these industries appear to the Adviser on Agriculture to the Secretary of State for the Colonies.

Very few, if any, matters of importance have been omitted from consideration in the report. Such criticisms as are contained are of a constructive nature and on that account the report will undoubtedly prove a valuable handbook for the guidance of local agricultural effort.

Following a short history of agricultural development, a description of the agricultural activities of the present time is given. Included is a reference to Fijian agriculture which is now in a transitional stage. The sugar, coconut and banana growing industries are dealt with in some detail. Other existing crops are mentioned and notes on additional crops which show promise of development are given. A general description of the animal industry follows and the possibility of the introduction of a hairy type of sheep and of making use of artificial insemination are discussed. Agricultural education and training and the fostering of agricultural settlements are important spheres of the Agricultural Department's activities and these subjects come under the review of the Adviser. A short reference is made to forests and to the secondment of a qualified Conservator of Forests: this appointment has now been made.

The work of the Department of Agriculture comes under consideration and recommendations are made for its future organization. After a short description of plant importation regulations, a summary of recommendations covering the whole sphere of agricultural activity in Fiji is given. The report concludes with some notes on agriculture in the Western Pacific High Commission Territories.

An appendix gives the very interesting itinerary of the Adviser and a map of the Fiji Islands with the distribution of the various crops is included.

* Report by Sir Frank Stockdale, K.C.M.G., C.B.E., on his Visit to Fiji, 1937. (C.A.C. 365). Colonial Office, May, 1938.

—C.R.T.

REVIEWS.

"INSECTS OF CITRUS AND OTHER SUBTROPICAL FRUITS."

THIS book—published at five dollars by the Comstock Publishing Company of Ithaca, New York—is stated by its author to be an attempt to discuss fairly adequately the insects and mites that attack, in different parts of the world, all citrus fruits as well as avocado pear, grapes, walnut, almond, pecan, fig, olive, date, persimmon, pomegranate and cherry. In addition, there is a chapter on the non-insect pests including gophers, mice, squirrels, nematodes and snails.

"The zone of the orange" has been used as a name to describe the subtropics because citrus flourishes within what is gererally understood as the subtropical area; its limits cannot be too clearly defined owing to the presence of ocean currents and elevated land, both of which alter the climate.

The local reader will be struck by the omission from the map of the world (showing the chief citrus areas) of any indication that this crop is grown between eastern Australia and western South America. The Cook Islands (Rarotonga) alone exported in 1936, £25,700 worth of citrus fruit and while this is not, of course, comparable to the value from such countries as Palestine which has specialized in this crop, a reference of some kind should be made to the South Sea Islands.

The book is frankly one primarily for the entomologist as it deals at great length with the structure, habits and life histories of the various insects, but the two chapters on cyanide fumigation and control by means of spraying and dusting are very valuable indeed for the non-specialist.

The Fiji fruit fly, *Chætodacus passifloræ* Frogg., is dealt with in two and a half lines, and although a reference is given to Simmonds' Bulletin No. 19, neither mandarin nor granadilla are listed as host plants. In dealing with the chemical control of this pest, importance is attached to "Clensol" and pollard though Simmonds showed (1) that the Queensland ammonia/vanilla lure was three times as effective as pollard and ten times as "Clensol." Some details might have been expected of the use of sodium fluosilicate as a poison bait as this element seems to be holding its own against the barium salt which alone is mentioned.

Other omissions are the Australasian *Leptoglossus* of which two American species only are listed though *L. membranaceus* F. does great damage in Queensland (2); the scales *Fiorinia*, *Icerya* and *Coccus hesperidum* all occur in Fiji on citrus but this is not recorded in their range of distribution, while the pest *Mictis profana* is not believed by the writer to occur out of Australia though it damages the tender leaves of citrus in this Colony.

In dealing with avocado pear, no reference is made to the borer *Xyleborus* reported in 1934 by Paine from Taveuni, Fiji, which is the more surprising as McKenzie's Bulletin of 1935 gives this genus as a pest in Hawaii.

This book is certainly a valuable one for anyone who means to go in for citrus growing on a large scale as it makes a serious attempt to give details and control of the huge majority of the citrus pests of the world which is no mean undertaking.

(1) Simmonds, H. W., 1937. *Agric. Jour.*, Fiji, Vol. 8, No. 3, July.
(2) Tryon, H., 1917, Queensland Annual Report, Dept. Agric. and Stock.

—R.J.A.W.L.

REVIEWS.

COCONUT PESTS AND DISEASES.

By

H. W. SIMMONDS, O.B.E.

(Government Printer, Fiji. 2/-).

This is a complete revision, with much new material added, of the author's Bulletin No. 16, which was published in 1925 and now republished as No. 20.

The writer has been engaged for twenty years in investigating the insects of the Southern Pacific and so is peculiarly well fitted to deal with those pests affecting the coconut palm in this widely scattered region.

Attention is directed in the foreword to the control of the leaf scale *Aspidiotus* by the introduction from the West Indies of the predaceous ladybird *Cryptognatha*, thereby repaying the debt to the South Seas contracted by the introduction from these islands of the breadfruit to the West Indies in 1796. The second successful example of biological control is the leaf-mining beetle *Promecotheca* which within a year was reduced in status from a major pest to a very scarce insect through the attacks of a minute Javan " wasp " *Pleurotropis*.

The area covered is some 5,000 miles from Tahiti in the east to New Guinea in the west and all the important insects are described and measures given for their control. The references to journals number 37 and a useful table gives the name, original home, part of tree injured and natural enemies of over 50 pests.

—R.J.A.W.L.

THE VALUE OF IDENTIFICATIONS TO ECONOMIC ENTOMOLOGISTS.

One oftens hears criticism levelled against research on insect nomenclature or identification on the grounds that it is an academic subject of value only to systematists who describe new species on the basis of an extra spine, spot or joint. Such criticism often emanates from sources which might have been expected to encourage rather than condemn these studies as being of no economic importance.

An instance of the short-sightedness of such a belief is well shown in a recent East African Journal* which devotes an editorial and a long article to work on the Kenya coffee mealy bug which is still a major burden on the coffee industry and also attacks cotton and various root crops.

When first sent home in 1909 this insect was believed to be *Pseudococcus citri* (Risso) but when it reacted epidemic proportions in 1923 it was re-identified as *P. lilacinus* Ckll. Accordingly, an Aphelinid wasp and predaceous ladybird were introduced, but although the former stung its mealy bug host, no offspring arose. When it was found that the parasite had thus failed, suspicion was again attached to the identification of the bug which was found to be in reality an unknown species later described in 1935 as *P. Keynæ* Le Pelley. Once it was recognised that a new insect was to be dealt with, completely different parasites were required and no further interest was taken in those of the Oriental P. *lilacinus*.

Here then is a clear case of the value of systematic work applied to or economic entomology which last failed to make any progress until so-called academic research elucidated that two different species were involved.

* East African Agricultural Journal, Vol. III, No. 6, May, 1938.

—R.J.A.W.L.

EXTRACTS.

WORLD ACREAGE UNDER CULTIVATION OF COCONUTS.

THE following acreage figures in relation to the principal countries producing coconuts on a commercial scale are of interest:—

	Acreage.	*Percentage of total acreage*
India	1,400,000	20
Ceylon	1,100,000	15
British Malaya	600,000	8
British South Seas Islands	600,000	8
British West Indies	100,000	1
British Borneo, Kenya and other British countries	100,000	1
Dutch East Indies	1,500,000	21
Philippine Islands	1,400,000	20
Foreign South Sea Islands	300,000	4
Siam	100,000	1
Mozambique, French Indo-China and other foreign countries	100,000	1
	7,300,000	100

—Journal of Coconut Industries, Ceylon, Vol. 1, No. 1, 1937.

In the New Guinea Agricultural Gazette, Volume 2, No. 2 of 1936, the following estimated areas under coconuts are given for the British South Sea Islands:—

Mandated Territory of New Guinea	198,051	acres.
Fiji Group	130,772	,,
British Solomon Islands Protectorate	62,309	,,
Tongan Islands Protectorate	54,397	,,
Mandated Territory of Western Samoa	52,949	,,
Territory of Papua	49,072	,,
Gilbert and Ellice Islands	20,000	,,
Mandated Territory of Nauru	900	,,
	568,450	acres.

(The area assigned to Fiji would appear to be excessive.—H.W.J.)

QUALITY OF CEYLON COPRA.

" Ceylon already enjoys the undisputed pride of place among the copra-producing countries of the world, as can be seen from the fact that Ceylon copra obtains the highest prices in the world market for quality. If the tendency to improve the quality of copra is encouraged to the fullest possible extent, through the stimulus provided by higher and higher rates, the present reputation of Ceylon copra will be enhanced so that this merit will constitute a distinct and unchallengeable asset in overseas markets also. Manufacturers abroad use Ceylon copra of the best quality for special purposes, and Ceylon can make it possible for a special reputation to be established in respect of this demand. Altogether, it is evident that Ceylon estates should realise in its full and manifold significance that quality pays."

—The Journal of Coconut Industries Ceylon, Vol. 1, No. 1, 1937.